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C66-00096

NASA APPROVED SPECIFICATION

THIS SPECIFICATION IS A CONTRACT SPECIFICATION AND IS SUBJECT TO CONFIGURATION MANAGEMENT CHANGE CONTROL PROCEDURES.

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SID 64-1083

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BP END ITEM SPECIFICATION

PART 1

PERFORMANCE/DESIGN REQUIREMENTS BOILERPLATE 30 (U)

22 September 1965

Contract NAS9-150

Exhibit I, Paragraph 4.2

Approved by

Dale D. Myers, Vice President
Apollo Program Manager

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

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BOILERPLATE 30

1.0 SCOPE

1.1 Scope.- Part I of this specification establishes the requirements for performance and design of one Apollo Command/Service Module (CSM) Block I Configuration Boilerplate, identified as and hereinafter referred to as BP 30 which shall provide capabilities for an unmanned LEM mission.

1.2 Objective.- The objective of this specification is to serve as a contractual document to provide baseline performance and design requirements for BP 30 system baseline hardware. Performance and design requirements for BP 30 shall be in accordance with the Block I configuration defined in Specification SID 64-1237 except for deviations specified herein. Paragraph numbers and titles designated "No change" are listed for convenience in locating common requirements in this specification and Specification SID 64-1237.

2.0 APPLICABLE DOCUMENTS

2.1 Project Documents.- The following documents, of the issue date specified, form a part of this specification to the extent specified herein. The asterisk (*) adjacent to a document number indicates that further review and mutual agreement as evidenced by a supplemental agreement to the contract is required prior to incorporation of the document into this specification.

North American Aviation, Inc. Space and Information Systems Division (NAA) S&ID

SID 63-313 22 February 1965	CSM Technical Specification (Block I)
SID 64-1237 22 February 1965	CSM Master End Item Specification (Block I)
SID 64-1344 22 February 1965	CSM Technical Specification (Block II)
*SID 63-580	Apollo Measurement Requirements, BP 30
13M20608 4/9/65 (MHO-AB253-12)	IU to Spacecraft Physical Requirements as amended by NAA IRN 00724
13M20617A 6/7/65 (MH01-AB069-124A)	Envelope LEM/IU/SIVB Clearance Physical

[redacted]

* 13M02508 (MH01-AB255-414)	LV to SC Procedural Requirements
* 13M06508 (MH01-AB254-414)	LV to SC Functional Requirements
* 40M37510 (MH01-AB084-224)	Definition of Saturn SA-206 and Apollo BP 30 Electrical Interface
* 80M90206 (MH01-AB206-414)	Flight Mechanics, Dynamics, Guidance and Control Interface Document Saturn IB (BP 30)
13M60002 9/16/64 (MH01-AB093-414)	Frequency Analysis, Saturn IB as amended by NASA IRN's R-1, dated 2/26/65 and R-2 dated 6/9/65.
* 13M60003 (MH01-AB259-414)	Saturn Apollo Frequency Plan
* 13M62061	Instrumentation and Communication Interfaces, Apollo Mission A206

2.2 Precedence.- The order of precedence in case of conflict shall be as follows:

(a) The Contract

(b) This specification

(c) Other documents referenced herein.

3.0 REQUIREMENTS

3.1 Performance

3.1.1 Operational Requirements.- Delete the text and substitute: "The operational requirements for BP 30 shall be as specified herein."

3.1.1.1 Mission Objectives.- The objective of the BP 30 mission will be to place a complete unmanned Lunar Excursion Module (LEM) into an earth orbit for verification of LEM subsystems operation.

3.1.1.2 Mission Requirements.- The unmanned CSM-LEM spacecraft will be launched with a Saturn IB from CAPE KENNEDY (KSC). The spacecraft will be rolled to a predetermined flight azimuth which will provide desired booster and spacecraft Manned Space Flight Network coverage within range safety limits.

After S-1B separation has been accomplished, the S-IVB will be ignited. The LES jettison motor will be used to jettison the LES and the CSM as a unit. Time of jettison may be anytime after normal LES jettison (20 seconds after S-IVB ignition). The SLA and LEM will be carried into an earth orbit by the S-IVB.

The SLA panels will be deployed subsequent to SM/SLA separation. After SLA panel deployment and S-IVB stabilization in orbit, the LEM will effect separation by LEM RCS activation and will perform the remainder of the mission independently.

There will be no re-entry phase.

3.1.2 Operability.-

through

3.1.2.5 Transportability.- No change.

3.1.2.6 Crew Performance.- Delete.

3.1.2.7 Safety.- No change.

[redacted]

3.1.2.8 Induced Environment.- Delete text and substitute: The induced environment shall be as specified in Specification SID 63-313 except for the following deviations herein:

3.1.2.8.2 CSM Flight Environments.- Delete items:

(b) Oxygen atmosphere

(c) Humidity

(d) Corrosive contaminants

3.1.2.8.2.1 Ascent Phase.- Delete items:

(a) Temperature

(b) Pressure

3.1.2.8.2.2 Earth Parking Orbit, Translunar Injection, Translunar Coast, Lunar Orbit Insertion, Lunar Operations, Transearth Injection, Transearth Coast, and Pre-Entry Phases.-

through

3.1.2.8.3 Command Module Post Landing Environments.- Delete.

3.2 Interface Requirements.- No change.

3.2.1 Launch Vehicle.- Delete text and add the following: The interface requirements shall be in accordance with SID 63-313 except as noted herein:

"3.2.1.3.6 SLA/IU Interface Loads.- The loads for design of the SLA shall be in accordance with Specification SID 64-1344 except that the following load parameters shall apply:

	S Shear (1000 lbs)	P Axial Load (1000 lbs)	M_A Moment (1000 in. lbs)	ΔM_z Moment (1000 in. lbs)	ΔM_y Moment (1000 in. lbs)
Adapter/IU Interface (STA502)	86.9	-285.8	30,200	22.7	-136.6

3.2.1.6.1.b "Q" Ball to CSM Interface.- Delete.

3.2.1.7.2 "Q" Ball Interface Provisions.- Delete.

3.2.1.7.5 Launch Vehicle Emergency Detection System (LV-EDS).-

through

3.2.1.8 Thrust Tail-Off Characteristics.- Delete.

3.2.1.9 Launch Vehicle Interface Control Drawings.- Launch vehicle interfaces will be as described in the ICD's:

13M20608	IU to Spacecraft Physical Requirements
13M20617A	Envelope LEM/IU/SIVB Clearance Physical
13M02508	LV to SC Procedural Requirements
13M06508	LV to SC Functional Requirements
40M37510	Definition of Saturn SA-206 and Apollo BP 30 Electrical Interface
80M90206	Flight Mechanics, Dynamics, Guidance and Control Interface Document Saturn IB (BP 30)
13M60002	Frequency Analysis, Saturn IB
13M60003	Saturn Apollo Frequency Plan
13M62061	Instrumentation and Communication Interfaces, Apollo Mission A206"

3.2.2 Guidance and Navigation.-

through

3.2.4 Scientific Equipment.- Delete.

3.2.5 GFE-ACE.-

through

3.2.7 Manned Space Flight Control Center and Manned Space Flight Network.- No change.

3.2.8 R&D Instrumentation.- Delete.

3.3 Design and Construction.-

through

3.3.1 General Design Features.- No change.

3.3.1.1 General Arrangement.- Delete text and replace with: "The general arrangement shall be as shown in Figure 1 of this Specification."

3.3.1.2 Design Criteria.- Delete text and replace with the following: "The design criteria shall be as defined in SID 63-313 except that the SLA shall be designed to the loads given in paragraph 3.2.1.3.6; the SLA shall have an ultimate factor of 1.4 applied to limit loads."

3.3.1.3 Weights.- Delete the text and Tables II through V and replace with the following: "The basic design control weights shall not change; however, the preliminary estimated spacecraft module flight weights specified in Table I are consistent with the design configuration delineated herein and the individual LES, CM and SM weights may vary within the limiting total weight. Updating of these estimates will be accomplished by means of the periodic mass properties reports."

TABLE I

Item	Weight (lbs.)
Launch Escape System	2520
Command Module	3950
Service Module	2035
TOTAL	8505
Spacecraft LEM Adapter	3700

3.3.2 Specifications and Standards.-

through

3.3.3.2 Toxic Materials.- No change.

3.3.3.3 Unstable Materials.- Delete last sentence in paragraph.

3.3.4 Standard Materials, Parts, and Processes.-

through

3.3.6.2 Electrical Conductivity.- No change.

3.3.7 Interchangeability and Replaceability.- Delete text and substitute:

"Not Applicable".

3.3.8 Workmanship

through

3.3.16 Ground Support Equipment.- No change.

3.4 Requirements of sub-Areas.- No change.

3.4.1 Command and Service Modules.- No change.

3.4.1.1 CSM Structural Subsystem.- No change.

3.4.1.1.1 Launch Escape Tower.- Delete the last three sentences, "An adjustment range...for the boost protective cover.", and replace with the following: "The lower ends of the tower legs (explosive bolt housings) shall be of a configuration which will mate with the CM, and the tower legs shall be attached to the CM by means of conventional bolts."

3.4.1.1.2 Command Module Structure Subsystem.-

through

3.4.1.1.2.3.3 Crew Compartment Heat Shield.- Delete and substitute the following:

"3.4.1.1.2 Command Module Structure Subsystem.- The Command Module (CM) shall consist of boilerplate structure with no provisions for equipment or ballast. The CM shall withstand a positive internal differential pressure of 11 PSI without structural failure. Sufficient sealing shall be provided to protect the CM interior from external elements; however, there are no design leakage requirements.

3.4.1.1.2.1 Command Module Structure Subsystem Requirements.- The CM shall be of conical design, approximately 135 inches high and 154 inches in diameter at the base. The CM shall simulate the SC command module and shall be capable of surviving ground handling and Saturn IB boost environments as described in Specification SID 63-313. The CM structure shall be capable of surviving the environment created by jettison by means of a boilerplate type LES while rigidly connected to an off-loaded service module (SM) as described in this specification. Interface connections shall be suitable to a boilerplate launch escape tower and a SC type SM. There shall be no requirements for equipment support structure in the CM. The configuration of the CM shall be aerodynamically similar to the Block I SC/CM. The CM structure shall include the following:

a. Cabin housing.

(1) Forward crew compartment.

(2) Aft crew compartment.

b. Forward compartment heat shield.

c. Aft compartment heat shield. (Simulated)

3.4.1.1.2.2 Command Module Structure Subsystem Function.- The CM structure shall function primarily as an aerodynamic fairing for the forward portion of BP 30. The CM structure shall also carry boost and jettison loads between the SM and LET."

3.4.1.1.2.3 Command Module Structure Description.- Delete text.

3.4.1.1.2.3.1 Outer Structure.-

through

3.4.1.1.2.3.3 Crew Compartment Heat Shield.- Delete and substitute the following paragraphs:

"3.4.1.1.2.3.1 Cabin Housing.- The CM shall be constructed of aluminum alloy welded into two assemblies; the forward crew compartment and the aft crew compartment. The subassemblies shall be bolted together and the aft skirt frames and skin shall be attached by mechanical fasteners. A through vent shall be provided from the aft bulkhead through the cabin housing to the forward bulkhead, penetrating both bulkheads. The cabin housing shall be sufficiently pressure tight to prevent the interior crew compartment area from being exposed to external elements prior to and during the boost phase.

a. Forward Crew Compartment Section.- The forward crew compartment section shall consist of multi-stiffeners welded to an outer skin. The stiffeners shall include four main longerons attached to the launch escape tower fittings in the forward bulkhead and terminating in the midring splice joint at the aft end of the forward section. Several secondary longerons shall be utilized for load transfer from the forward bulkhead to the midring. The remaining stiffeners shall assist the skin in resisting airloads. The forward bulkhead structure shall consist of a double skin with riveted stiffeners. The closeout skin shall be attached to stiffeners by blind fasteners. The egress tube shall consist of a sheet tube of aluminum welded to

the forward bulkhead. A cover plate shall be bolted to the top of the egress tube. An access hatch shall provide access to the CM interior and shall be located as on the spacecraft CM. The cover plate shall be constructed of reinforced aluminum plate, bolted into place. Access doors shall be provided in the skirt structure for access to the aft compartment. Four openings shall be provided, capable of allowing installation of telemetry antennas. These openings shall be covered with sealed plates. GSE attach points shall be located on the exterior of the CM at approximately 90-degree intervals and immediately aft of the forward bulkhead. Other GSE attach points shall be externally located at approximately 90-degree intervals immediately forward of the aft bulkhead.

b. Aft Crew Compartment Section.- The aft section of the crew compartment shall consist of a sidewall with stiffeners, corresponding to those of the forward crew compartment, from the mating aft section of the crew compartment mid-ring to the machined ring forging at the junction of the sidewall and the floor. Fittings shall be included which are nonseparating SC type tension ties between the CM and SM to enable jettison of the CM and SM combined.

3.4.1.1.2.3.2 Forward Compartment Heat Shield.- The forward compartment heat shield shall form the forward section of the CM structure and shall consist of an aluminum alloy skin and stiffeners utilizing riveted and bolted construction. The nose cone shall be aluminum. The aft section of the forward compartment heat shield shall be attached to the CM crew compartment forward bulkhead where the four main longerons terminate. Attachment shall be accomplished by means of four bolts through the forward bulkhead in addition to the four LES tower leg attach and separation type non-explosive bolts.

3.4.1.1.2.3.3 Aft Compartment Heat Shield.- The aft compartment heat shield shall be attached at the spacecraft ablative mold line and shall form the outer (blunt) section of the CM. The heat shield shall simulate the spacecraft heat shield and shall be fabricated of glass cloth laminations with an aluminum honeycomb core sandwiched between the inner and outer surfaces. The heat shield shall be mounted to the CM aft section ring by three pad fittings, installed on the heat shield inner surface, which shall transmit boost shear and compression loads between the SM and CM. Provisions shall be made, adjacent to the fittings, for the CM-SM tension ties to penetrate the heat shield. Boost compression loads are also transmitted by three additional pure compression pads located between the shear-compression pads."

3.4.1.1.2.3.4 Aft Heat Shield.-

through

3.4.1.1.2.4.7 Air Pressure Regulator Controls.- Delete.

3.4.1.1.2.5 Command Module Thermal Protection Subsystem.- Delete text and substitute the following: "The exteriors of the forward compartment heat shield, forward crew compartment section, aft crew compartment section, and a portion of the aft compartment heat shield shall be covered with cork ablator to provide thermal protection to the CM structure during the boost environment."

3.4.1.1.2.5.1 Requirements.-

through

3.4.1.1.2.5.3.2 Insulation.- Delete.

3.4.1.1.2.6 Earth Impact and Flotation Subsystem.-

through

3.4.1.1.2.6.6.1.6 Sea Pick-up Provisions.- Delete.

3.4.1.1.3 Service Module Structure Subsystem.- Delete items f., g., h., i., and last sentence.

3.4.1.1.3.1 Service Module Structure Subsystem Requirements.-

through

3.4.1.1.3.1.1 Interface Provisions.- No change.

3.4.1.1.3.1.1.1 Reaction Control System.-

through

3.4.1.1.3.1.1.2 Service Propulsion System.- Delete.

3.4.1.1.3.1.1.3 Command Module.- In the fourth line, place a period after the word "ties", and delete the following: "which can be cut... (see 3.4.1.1.3.3.6)." Delete the last sentence.

3.4.1.1.3.1.1.4 Ground Support Equipment (GSE).- Not applicable, however, the SM basic structural access provisions shall remain the same as the Basic Block I vehicle except that such access holes may be covered with simplified cover plates, as applicable. SM purging provisions will be retained.

3.4.1.1.3.1.1.5 Service Module - SLA.- No change.

3.4.1.1.3.1.1.6 Electrical Power System.-

through

3.4.1.1.3.1.1.7 Environmental Control System.- Delete.

3.4.1.1.3.1.1.8 Electrical Wiring.- No change.

3.4.1.1.3.1.1.9 Temperature Control System.-

through

3.4.1.1.3.1.1.11 Sequencers.- Delete.

3.4.1.1.3.2 Service Module Structure Subsystem Function.- Delete text and substitute: "The SM structure shall withstand the operating conditions of the LEM propulsion mission up to CSM separation from the SLA, without yield or permanent deformation."

3.4.1.1.3.3 Service Module Structure Subsystem Components.- No change.

3.4.1.1.3.3.1 Outer Shell.- Delete the third and fourth sentences.

3.4.1.1.3.3.2 Radial Beams.-

through

3.4.1.1.3.3.4 Aft Bulkhead.- No change.

3.4.1.1.3.3.5 Inner Webs.- Delete last sentence.

3.4.1.1.3.3.6 CS - SM Separation.-

through

3.4.1.1.3.3.9 Systems Support.- Delete.

3.4.1.1.4 Spacecraft-LEM Adapter (SLA).- Delete text and replace with the following: "The SLA will be used to provide the structural connection from the CSM to the booster and to enclose and support the LEM."

3.4.1.1.4.1 SLA Requirements.-

through

3.4.1.1.4.1.1.1 Adapter Forward Section Loads.- No change.

3.4.1.1.4.1.1.2 Adapter Aft Section Loads.- Delete text and replace with the following: "The adapter aft section, in addition to the loads specified in 3.4.1.1.4.1.1.1 shall withstand the loads imposed by the structural support of a 32,000 pound LEM. Mounting provisions for the LEM will be provided."

3.4.1.1.4.2 Interface Provisions.-

through

3.4.1.1.4.2.1 Service Module Structural Interface.- No change.

3.4.1.1.4.2.2 S-IVB Instrument Unit.- Delete text and replace with the following: "The launch vehicle interface shall occur at the structural attachment of the SLA to the S-IVB instrument unit, and the interface umbilical connection to the IU. Space allocations are provided in the lower SLA/IU interface for IU electrical requirements."

3.4.1.1.4.2.3 Electrical Wiring.- Delete text and replace with the following: "The electrical wiring shall interface with the Service Module on the forward end in an umbilical disconnect and with the S-IVB Instrument Unit at the aft end, also with an umbilical disconnect."

3.4.1.1.4.2.4 Ground Support Equipment.- Delete text and replace with the following: "The interface with the GSE, shall occur in provisions for access to the SLA interior and to the servicing points and external umbilical connectors on the LEM and on the SLA and Service Module. These provisions are related to the interfaces with the LEM and with the Launch Operations. Interface for electrical checkout of SLA systems shall be with the SIVB instrument unit umbilical. Ground handling and transportation equipment interfaces are included. The internal removable work platforms shall interface with the SLA and the LEM."

3.4.1.1.4.2.5 Sequencers.- Delete text and replace with the following: "The interface shall occur at the electrical connection to the SLA and SLA-LEM separation systems."

Add new paragraph as follows:

"3.4.1.1.4.2.6 LEM.- The LEM-SLA interfaces occur at the support points for the LEM in the SLA aft structure and at the umbilical connections to the LEM. The access and servicing requirements and the space allocation and clearances within the SLA and the Launch vehicle upper stage are also part of this interface.

3.4.1.1.4.3 SLA Functions.- No change.

Add new paragraph as follows:

"3.4.1.1.4.3.1 SLA Performance.- The SLA shall withstand, without deterimental effect, the environments specified in SID 63-313 as defined herein. The SLA separation devices shall separate and deploy the SLA panels so as to permit CSM-SLA separation and LEM separation from the boost vehicle - SLA combination.

3.4.1.1.4.4 Components.- No change.

3.4.1.1.4.4.1 Outer Shell.- Delete text and replace with the following: "The outer shell shall consist of four hinged forward panels and an aft structure which remains attached to the launch vehicle. The shell shall be of aluminum honeycomb sandwich construction with end rings for attachment to the Service Module and S-IVB Instrument Unit."

3.4.1.1.4.4.1.1 Separation Devices.- Delete text and replace with the following: "The separation devices shall operate in the following sequence: The CSM shall be separated from the SLA-SIVB at the time of LES jettison. The four forward panels, forming the upper portion of the SLA, shall be separated from each other and from the aft SLA structure by redundant mild detonating fuse ordnance subsequent to the SM-SLA separation. The panels shall be hinged at the aft end and shall be deployed outward to 45+5 degrees measured to the vehicle centerline (x - x axis) and secured in position to provide clearance for LEM separation and withdrawal from the SLA. The deployment impulse shall be provided by pyrotechnic thrusters with panel shock attenuation and retention by mechanical devices. The SLA-LEM umbilical shall be severed by redundant pyrotechnic devices at the time of panel deployment. The LEM shall be disconnected from the SLA by severing the tie-down straps with redundant ordnance devices. The LEM-SLA antenna cable shall be severed simultaneously with the LEM-SLA separation. All pyrotechnic batteries and sequencer units required for these operations shall be located in the SLA. The SM to SLA umbilical shall be severed simultaneously with the SM/SLA separation."

3.4.1.1.4.4.1.2 System Support.-

through

3.4.1.1.4.4.1.3 Venting.- No change.

3.4.1.1.4.4.1.4 Service and Access.- Delete text and replace with the following: "Provisions shall be made for service and access to the LEM and SLA interior through openings in the SLA as shown in the following list:

SLA Station X_A	Circumferential Location (Plus 1 1/2 Deg)	Opening Size
521.50	20 deg Off -Z Axis Toward +Y Axis	10" Diameter
551.00	20 deg Off -Z Axis Toward +Y Axis	10" Diameter
661.75	34 deg Off -Z Axis Toward +Y Axis	10" Diameter
551.00	20 deg Off -Z Axis Toward -Y Axis	10" Diameter
611.75	30 deg Off -Y Axis Toward -Z Axis	10" Diameter
708.25	13 deg Off -Z Axis Toward -Y Axis	8.5" wide, 17" High, 3" corner radii
611.75	32 deg Off -Y Axis Toward +Z Axis	10" Diameter
519.50	39 deg Off +Z Axis Toward +Y Axis	6" Diameter
611.75	33 deg Off +Y Axis Toward +Z Axis	6" Diameter
707.75	33 deg Off +Y Axis Toward +Z Axis	10" Diameter
634.5	On +Z Axis	34" x 34", 6" corner radii
634.5	On -Z Axis	28" x 34", 6" corner radii

Provisions shall be made in the SLA for the attachment and support of platforms required for the access and servicing of the SLA and the LEM. These platform levels shall be at SLA Stations X_A =525.0, 603.0, 638.5 (+Y axis only), 660.0 (-Y axis only), 697.0, 720.0 (+Z axis only) and 760.0 (movable)."

Add new paragraph as follows:

"3.4.1.1.4.4.1.5 LEM Support.- Fittings shall be provided on the aft structure to support a 32,000 pound LEM at four points. Each of these points shall provide adjustment capability and shall include tie-down straps with the provisions for severing to achieve separation of the LEM from the SLA."

3.4.1.2 Mission Support.- Delete text and substitute the following: "This section includes performance and design requirements for the following subsystem required to support the BP 30 mission: Electrical Power Subsystem (EPS)."

3.4.1.2.1 Electrical Power Subsystem (EPS).- Delete text and substitute the following: "The EPS shall provide the electrical energy storage and electrical power distribution consistent with the mission requirements as defined in this specification."

3.4.1.2.1.1 Electrical Power Subsystem (EPS) Requirements.- Delete text and substitute the following: "EPS equipment shall provide the electrical power. The electrical power requirements shall be satisfied by the use of storage batteries and pyrotechnic batteries during the launch and flight phases of the mission. The allowable energy for the BP 30 mission as defined in this specification shall be 5 ampere-hours per "logic" battery, and 0.75 ampere-hours per "Pyro" battery."

3.4.1.2.1.1.1 Load Grouping.- Delete.

3.4.1.2.1.1.2 External Power.- Delete.

3.4.1.2.1.1.3 Electrical Distribution Panels.- Delete.

3.4.1.2.1.1.4 Power Return System Type.- No change.

3.4.1.2.1.1.5 Electrical Power Distribution Equipment (EPDE).- Delete text and substitute the following: "The EPDE characteristics shall be as follows, as sensed at the Spacecraft Jettison Controller (SJC) buses:

a. Logic Buses

1. No-load voltage limits: 31 volts plus or minus 1.5 volts.

2. Transient voltage limits: 26 volts to 33.5 volts with recovery to steady state within one second.

3. Steady state limits (under load): 28.5 volts plus or minus 2.5 volts.

4. Minimum logic battery capacity: 5 ampere-hours at a 3 ampere rate. End life voltage shall be 26.0 volts or greater.

b. Pyro Buses

1. No-load voltage limits: 37 volts plus or minus 1.5 volts.

2. Transient voltage limits: 22 to 38 volts with recovery to steady state within 1 second.

3. Steady state limits: 33 volts plus or minus 5 volts.

4. Minimum pyro battery capacity: 0.75 ampere-hours at an intermittant rate (initiator firings - 12 initiators at 15 amperes for a duration of 10 milliseconds each)."

[redacted]

3.4.1.2.1.1.6 Interfaces.- No change.

3.4.1.2.1.1.6.1 Displays and Controls.-

through

3.4.1.2.1.1.6.1.3 Control.- Delete.

3.4.1.2.1.1.6.2 Instrumentation.- Delete text and substitute with the following: "Provisions shall be made for measurements as defined in Specification SID 63-580."

3.4.1.2.1.1.6.3 Deadfacing Flight Umbilicals.- Delete and substitute the following: "Electrical circuits and power sources which require protection from shorting or grounding, during or after SM/SLA or LEM/SLA separation shall be deadfaced."

3.4.1.2.1.1.7 Electrical Power Subsystem (EPS).- Delete b. Power Generation and c. Power Conversion. Change d. Power Distribution to b. Power Distribution.

3.4.1.2.1.1.7.1 Energy Sources.- Delete text and substitute with the following: "Chemical storage batteries shall constitute the energy sources for electrical power."

3.4.1.2.1.1.7.1.1 Cryogenic Storage Section.-

through

3.4.1.2.1.1.7.1.3.12 Environmental Requirements.- Delete.

3.4.1.2.1.1.7.1.4 Chemical Battery Section.- Delete and substitute the following: "The chemical battery section shall include two logic batteries and two pyrotechnic type batteries."

3.4.1.2.1.1.7.1.4.1 Entry and Post Landing Batteries.-

through

3.4.1.2.1.1.7.1.4.1.1.1 Battery Vent Line Instrumentation.- Delete text and substitute "Intentional Blank."

3.4.1.2.1.1.7.1.4.1.2 Mounting and Temperature Control.- Delete text and substitute: "Passive thermal interface material shall be employed as required to maintain battery temperature within operating limits through lift-off up to and including one full orbit of the spacecraft."

3.4.1.2.1.1.7.1.4.1.3 Chemical Battery Section Performance.- Delete and substitute with the following: "Voltage for the chemical battery system shall be as follows:

a. Logic Batteries

1. Open circuit (Maximum) shall be 33.8 volts.

2. Nominal voltage while delivering 3 amperes shall be 29 plus or minus 2 volts.

3. Final voltage when the battery is considered to be at rated discharge, while delivering 3 amperes shall not be less than 26.0 volts.

b. Pyrotechnic-type batteries

1. Open circuit voltage (maximum) shall be 37.8 volts.

2. Nominal voltage while delivering 10 amperes shall be 34 plus or minus 2 volts.

3. Final voltage when the battery is considered to be at rated discharge, while delivering a current of 75 amperes, shall not be less than 20.0 volts."

3.4.1.2.1.1.7.1.4.1.3.1 State and Storage.- No change.

3.4.1.2.1.1.7.1.4.1.3.2 Capacity.- Delete text and substitute the following: "The logic battery shall develop 5 ampere-hours when discharged at 3 amperes to a minimum voltage of 26.0 volts during the first six cycles of discharge. The pyrotechnic-type battery shall develop 0.75 ampere-hours, when discharged at 75 amperes for 36 seconds to a minimum voltage of 20.0 volts, during the first six cycles of discharge."

3.4.1.2.1.1.7.1.4.1.3.3 Service Life and Recharge.- Delete.

3.4.1.2.1.1.7.1.4.2 Pyrotechnic and SM Jettison Controller Batteries.- Delete title and text and substitute:

"3.4.1.2.1.1.7.1.4.2 Pyrotechnic and Logic Batteries.- Silver-oxide-zinc batteries shall supply electrical power requirements. Pyrotechnic and logic batteries shall be located in the SLA. There shall be no provisions for in-flight charging. Envelope dimensions for pyrotechnic battery shall be as shown in Figure 24."

3.4.1.2.1.1.7.1.4.2.1 Design and Construction.-

through

3.4.1.2.1.1.7.1.4.2.4.2 Service Life.- No change.

3.4.1.2.1.1.7.2 Power Generation Equipment.-

through

3.4.1.2.1.1.7.3.2.5.3 Output Transient Voltage Recovery.- Delete.

3.4.1.2.1.1.7.4 Electrical Power Distribution Equipment.- Delete.

3.4.1.2.1.1.7.4.1 Protection.- Delete.

3.4.1.2.1.1.7.4.2 Operating Conditions.- Delete text and substitute with the following: "One logic battery and one pyro battery shall supply each of the two sequencer systems; each sequencer system being redundant to the other."

3.4.1.2.2 Environmental Control Subsystem (ECS).-

through

3.4.1.2.2.2.10 ECS Electrical Power Requirements.- Delete.

3.4.1.2.3 Crew Equipment Subsystem.-

through

3.4.1.2.3.11.9 Bioinstrumentation Provisions.- Delete.

3.4.1.3 Navigation, Guidance, Control and Propulsion.

3.4.1.3.1 Guidance and Control.- Delete.

3.4.1.3.1.1 Guidance and Navigation (G&N) Subsystem.-

through

3.4.1.3.1.1.1 System Requirements.- Delete.

3.4.1.3.1.2 Stabilization and Control Subsystem.-

through

3.4.1.3.1.2.3.2.12.3 Equipment Location and Dimensions.- Delete.

3.4.1.3.2 Command Module Reaction Control Subsystem (CM/RCS).-

through

3.4.1.3.2.2.5.7 Positive Sealing Provisions.- Delete.

3.4.1.3.3 Service Module Reaction Control Subsystem (SM/RCS).-

through

3.4.1.3.3.2.10.6 Test Ports.- Delete.

3.4.1.3.4 Service Propulsion Subsystem (SPS).-

through

3.4.1.3.4.1.9.8.2 Stud Feedthrough.- Delete.

3.4.1.4 Sequencing, Sensing, and Recovery.- Delete items c, d and e.

3.4.1.4.1 Sequential Events Control Subsystem.- Delete items a. through i. and substitute with the following:

"a. Spacecraft Jettison

b. SM/SLA Separation

c. SLA Panel Deployment

d. LEM/SLA Separation"

3.4.1.4.1.1 Requirements.-

through

3.4.1.4.1.1.1 Power Supplies.- No change.

3.4.1.4.1.1.1.1 Logic Power.- Delete text and substitute with the following: "Logic D.C. for the Spacecraft Jettison Controller (SJC) power shall be supplied by batteries located in the SLA. The power characteristics shall be as described in paragraph 3.4.1.2.1.1.7.1.4."

3.4.1.4.1.1.1.2 Pyrotechnic Power.- Delete text and substitute the following: "Two silver-oxide-zinc batteries shall supply electrical power requirements for firing of pyrotechnic devices. The pyrotechnic batteries shall be located in the SLA and shall be isolated from the logic power system. There shall be no provision for in-flight recharging. The performance, capacity and service life are defined in paragraph 3.4.1.2.1.1.7.1.4."

3.4.1.4.1.1.1.3 Circuit Protection.- Delete a. 2. and substitute "To protect wiring from deterioration caused by faults or overloads."

3.4.1.4.1.1.1.4 Vehicle Ground Point.- Add the following: "The vehicle ground point shall be located in the SLA."

3.4.1.4.1.1.2 Controllers.-

through

3.4.1.4.1.1.2.8 Interlock Controls.- No change.

3.4.1.4.1.1.2.9 Manual Capability.- Delete.

3.4.1.4.1.1.2.10 Test Points.-

through

3.4.1.4.1.2.1 Power Sources.- No change.

3.4.1.4.1.2.1.1 Logic D.C. Power.- Delete text and substitute the following: "Logic D.C. power shall be supplied by two batteries located in the SLA. Refer to paragraph 3.4.1.2.1.1.7.1.4 for description of the batteries."

3.4.1.4.1.2.1.2 Pyrotechnic Firing Power.- Delete text and substitute the following: "Silver-oxide-zinc batteries shall supply power for firing pyrotechnic devices. The pyrotechnic batteries shall be located in the SLA. Refer to Paragraph 3.4.1.2.1.1.7.1.4 for description of the batteries."

3.4.1.4.1.2.2 Controllers.- No change.

3.4.1.4.1.2.2.1 Sequential Events Control Subsystem.- Delete.

3.4.1.4.1.2.2.1.1 Master Events Sequence Controller-(MESC).- Delete title and text and substitute:

"3.4.1.4.1.2.2.1.1 Spacecraft Jettison Controller (SJC).- Signals shall be provided to initiate and terminate events associated with ascent, Launch Escape System Jettison, SM/SLA Separation, SLA Panel Deployment, and LEM-SLA Separation. Signals required for sequential events control shall be individually supplied by MSFN through the IU or the LEM."

3.4.1.4.1.2.2.1.2 Earth Landing Sequence Controller (ELSC).-

through

3.4.1.4.1.2.2.1.4 Command Module Reaction Control System Controller (CM/RCSC).- Delete.

3.4.1.4.1.2.3 Circuitry.-

through

3.4.1.4.1.2.4.4.1 Requirements.- No change.

3.4.1.4.1.3 Functions.- Delete text and substitute with the following: "The following functions are pyrotechnically initiated. (Refer to Figure 2).

Item	Subsystem
TJ Motor Ignition	LES
SM-SLA Separation	SLA Structure
Structural Panel Separation	SLA Structure
Umbilical	SLA Structure
Panel Deployment	SLA Structure
LEM/SLA Separation	LEM/SLA Separation
Antenna Umbilical severance	LEM/SLA Separation"

3.4.1.4.1.4 Performance.- No change.

3.4.1.4.1.4.1 Sequential Events Control Subsystem.- No change.

3.4.1.4.1.4.1.1 Apollo Ascending Events Sequence.-

through

3.4.1.4.1.4.1.4 Apollo Adapter Separation and SPS Abort Events Sequence.- Delete.

3.4.1.4.2 Launch Escape Subsystem (LES).- Delete text and substitute the following: "portions of the spacecraft launch escape subsystem shall be utilized to provide the following functional capabilities:

a. Provide an aerodynamic fairing for the launch vehicle.

b. Provide a means for jettisoning the CSM at the end of the atmospheric boost phase."

3.4.1.4.2.1 Subsystem Functions.- Delete.

3.4.1.4.2.2 Subsystem Description.- Delete text and substitute the following: "The LES shall consist of a tower structure and skirt, an expended launch escape motor, a live tower jettison motor, a modified prototype ballast enclosure, and a nose cone assembly. The tower jettison motor shall provide the impulse which will be required to jettison the CSM at the end of the atmospheric boost phase. The ballast enclosure and nose cone assembly replace the canard structure of the basic LES configuration."

3.4.1.4.2.3 Subsystem Operating Modes.-

through

3.4.1.4.2.5.9.5 Entry With Canards Deployed.- Delete.

3.4.1.4.2.6 Subsystem Equipment.- Delete the phrase "and abort functions."

3.4.1.4.2.6.1 Launch Escape Subsystem (LES).- Delete text and substitute the following: "The LES shall include the following components: (See Figure 1 for overall configuration.)

a. Nose Cone Assembly

b. Launch Escape Motor (Expended)

c. Structural Skirt

d. Tower Structure

e. Tower Jettison Motor

f. Prototype Ballast Enclosure (modified to attach to tower jettison motor)"

3.4.1.4.2.6.2 Q-Ball.- Delete and replace with the following new paragraph:

"3.4.1.4.2.6.2 Nose Cone Assembly.- A nose cone assembly fabricated from spun Inconel shall be provided. This assembly shall be attached to the prototype ballast enclosure and shall constitute the forward extremity of the LES."

3.4.1.4.2.6.3 Launch Escape Tower Canard System (LETCS).-

through

3.4.1.4.2.6.4.16 Temperature Limits, Storage and Handling.- Delete.

3.4.1.4.2.6.5 Launch Escape Motor.- Delete "a solid propellant motor ....herein" and replace with "an expended motor of the type employed for ....herein."

3.4.1.4.2.6.5.1 Motor Case Assembly.- No change.

3.4.1.4.2.6.5.2 Aft Closure Dome.- No change.

3.4.1.4.2.6.5.3 Fixed Exhaust Nozzles.-

through

3.4.1.4.2.6.5.4 Propellant Grain.- Delete.

3.4.1.4.2.6.5.5 Igniter Assembly.- Delete text and substitute the following: "An igniter assembly shall not be provided. A blank cover shall be provided to attach to the motor flange which normally supports the igniter assembly."

3.4.1.4.2.6.5.5.1 Igniter Cartridge.- Delete.

3.4.1.4.2.6.5.6 Cylinder Inner Liner.- Delete text and substitute the following: "The motor case assembly shall be cleaned of liner remnants and shall be coated on the inside with a rust preventive."

3.4.1.4.2.6.5.7 Seals.-

through

3.4.1.4.2.6.5.14 Temperature Limits, Storage, and Handling.- Delete.

3.4.1.4.2.6.6 Tower Jettison Motor.- No change.

3.4.1.4.2.6.6.1 Motor Case Assembly.- Delete the last sentence.

3.4.1.4.2.6.6.2 Motor Case Liner.-

through

3.4.1.4.2.6.8 Tower Structure.- No change.

3.4.1.4.2.6.9 Tower/Command Module Separation System (T/CMS).-

through

3.4.1.4.2.6.11.6 Thermal Protection.- Delete.

3.4.1.4.3 Earth Recovery Subsystem (ERS).-

through

3.4.1.4.3.8.4 Sequence Control Static Pressure Source.- Delete.

3.4.1.4.4 LV Emergency Detection Subsystem (LV-EDS).-

through

3.4.1.4.4.5.4.3 Schematic.- Delete.

[redacted]

3.4.1.4.5 Displays & Control Subsystem (D&C).-

through

3.4.1.4.5.3.5.7 Heat Transfer.- Delete.

3.4.1.4.6 Service Module Propellant Dispersal Subsystem.- Delete.

3.4.1.5 Information Acquisition.- In the third and fourth lines delete: "data storage, video, RF trajectory measurement,".

Delete the last sentence.

3.4.1.5.1 Communications Subsystem.- No change.

3.4.1.5.1.1 Communications Requirements.- Delete text and replace with: "The Communication Subsystem as defined herein shall provide 2 VHF/UHF antennas mounted on the SLA for use by the LEM for VHF Down Data transmission and UHF Up Data reception during the period prior to LEM/SLA separation."

3.4.1.5.1.2 Functions.- Delete text and replace with: "LEM/SLA R&D telemetry antennas shall be provided on the SLA to produce essentially omnidirectional coverage in a plane perpendicular to the CSM longitudinal axis before SLA panel deployment." Delete tables XIX, XX, and XXA.

3.4.1.5.1.2.1 Voice Communications.-

through

3.4.1.5.1.2.6.6 HF Orbital Antenna.- Delete.

3.4.1.5.1.3 Description and Performance Characteristics.- No change.

3.4.1.5.1.3.1 C-Band Transponder Equipment.-

through

3.4.1.5.1.3.15.1 Characteristics.- Delete.

3.4.1.5.1.3.16 Radio Frequency Coaxial Cables and Connectors.-

through

3.4.1.5.1.3.16.8 Cable Losses.- No change.

3.4.1.5.1.3.17 Signal Conditioning Equipment.-

through

3.4.1.5.1.3.27.1 Characteristics.- Delete.

3.4.1.5.1.4 Antenna Environments.-

through

3.4.1.5.1.4.5 HF Orbital Antenna.- Delete.

3.4.1.5.1.5 Add the following new paragraphs:

"3.4.1.5.1.5 Functions and Characteristics of Added Equipment.- The following paragraphs describe equipment functions which shall be added in support of the BP 30 mission.

3.4.1.5.1.5.1 LEM/SLA R&D Telemetry and Up Data Link (UDL) Antennas.- Two antennas shall be mounted on the aft section of the SLA at approximately X_a 565.0. The antennas shall be protruding type scimitar antennas. The antennas shall be diametrically opposed. The antennas shall operate from 230.0 to 260.0 mc and 450.0 mc utilizing appropriate equipments supplied in LEM.

3.4.1.5.1.5.1.1 Characteristics.-

VSWR	2:1 maximum at specified frequencies
Frequencies	230.9 mc 237.8 mc 241.5 mc 247.3 mc 257.3 mc 450.0 mc
Pattern Coverage	Essentially omnidirectional in the SM Y-Z plane (Combined pattern of two antennas)
Polarization	Linear
Power rating	50 watts (5 transmitters at 10 watts each

3.4.1.5.1.5.2 Power Divider.- The power divider shall be utilized to divide the RF energy for application to the two antennas.

3.4.1.5.1.5.2.1 Characteristics.-

VSWR	1.5:1 maximum
Frequency range	230 to 260 mc and at 450.0 mc
Insertion loss	0.5 decibel maximum

3.4.1.5.1.5.3 Co-Axial Cabling.- Cabling shall be supplied between the antennas and the power divider and from the power divider to the SLA/LEM interface."

3.4.1.5.2 Instrumentation Subsystem.- Delete text and substitute the following: "The operational instrumentation measurement requirements shall be in accordance with Specification SID 63-580".

3.4.1.5.2.1 Instrumentation Subsystem Requirements.- Delete text and substitute:
"Instrumentation shall consist of a sequencer and SLA panel SLA/CSM separation microswitch relay signals, transmitted through the LEM telemetry system. Power to and from the relays shall be supplied by the LEM."

3.4.1.5.2.2 Instrumentation Subsystem Performance.-

through

3.4.1.5.2.11 Additional Instrumentation Requirements.- Delete.

3.4.2 Training Equipment.- Delete.

3.4.3 Ground Support Equipment.-

through

3.4.4 Other Equipment.- No change.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 General Quality Assurance Program.-

through

4.4.1 Change Control.- No change.

5.0 PREPARATION FOR DELIVERY

5.1 Preservation, Packaging, and Packing.-

through

5.2.4 Transport.- No change.

6.0 NOTES

This section of this specification is not contractually binding. All information contained herein is for information only.

6.1 Definitions.-

through

6.1.5 Acronyms.- No change.

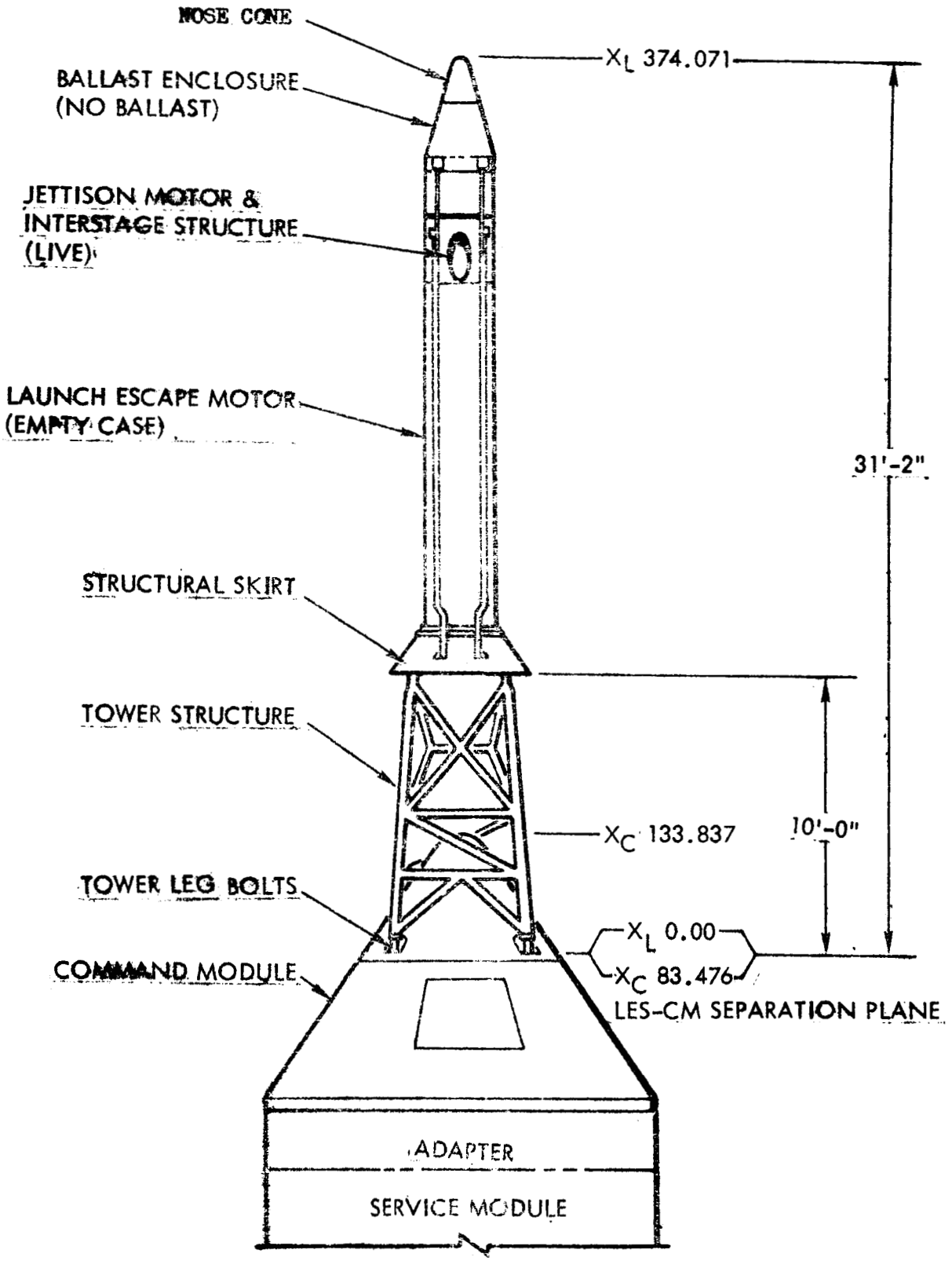

Figure 1. Launch Escape System Configuration (BP 30 ONLY)

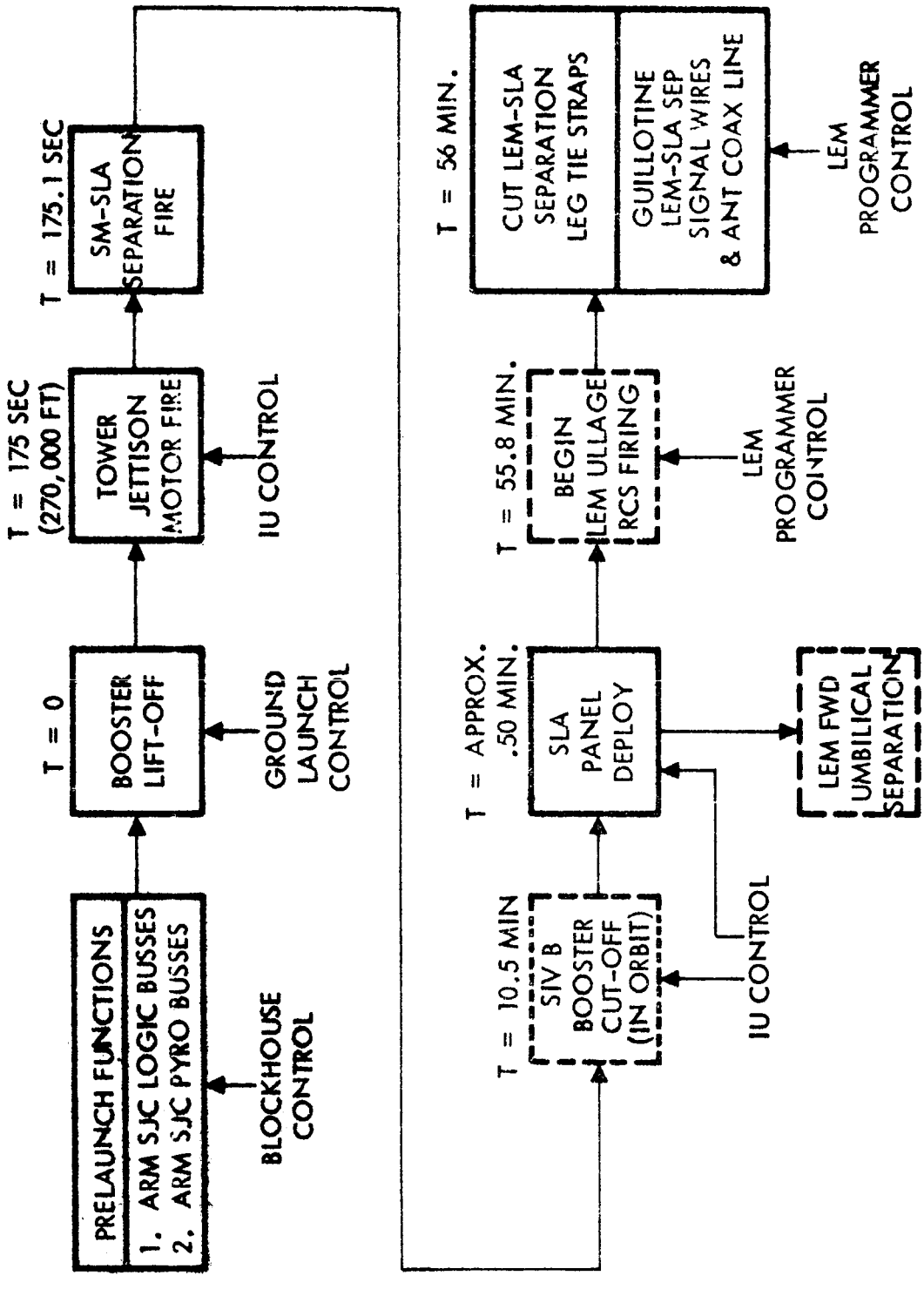

Figure 2. Functional Block Diagram Event Sequencer